To Perform Electrical Harmonic Analysis in Industry

Nilesh B. Mirajkar, R Dharaskar, P Kolhe
Assistant Prof, Diploma in Fisheries Engineering, Ratnagiri, Dr.BSKKV, Dapoli, India.

Abstract – Harmonics are components of distorted periodic waveforms whose frequencies are integer multiples of fundamental frequencies.The use of powers converters and other nonlinear loads in industry has increased the deterioration of the power system voltages and current waveforms. This Harmonic distortion is considered to be most significant reason for power quality problems. This paper discuss about collection of data, and its analysis performing harmonic analysis in industrial premises used to eliminate harmonics which improves the power qualities.

Index Terms – Harmonics, Harmonic distortion, Industries, Power quality.

1. INTRODUCTION

The increased use of power electronic devices results in harmonic interference problems in power transmission or distribution systems. The modern power electronic devices commonly used to describe the switch mode power supply which is found in personal computers, stereos, televisions, and electronic lighting and adjustable speed drives and static converters. The currents drawn by these power electronic converters and nonlinear loads have harmonics. Current harmonics present in these nonlinear loads further results in troublesome problems in AC power lines. The harmonics presence in the power lines results in varied problems, like: greater losses in distribution; problems of electromagnetic interference in communication systems; and operation failures of protection devices, electronic equipment's. These problems result in high costs and lead to a decreasing in productivity and reduction of quality in the products or services.

IEEE standard, American national standard guides (ANSI), British standards (BS), European norms (EN), etc. are followed to maintain electrical power quality. The IEEE standard 519 is a recommended practice for power factor correction and harmonic impact limitation at static power converters. IEEE-519 standard limits the total harmonic distortion (THD) of voltage and current below 5 %.

2. OBJECTIVE

The main objective of this paper is collection of data from industrial power system and to perform harmonic analysis on it.

Harmonic study of 'C' Cure Building Products Pvt. Ltd, Pune is carried out.

3. PLANT DESCRIPTION

The Plant under consideration is a manufacturing unit of steam cured Sand Lime bricks and Paving Blocks.

All the operations in the plant are mainly performed with the help of electrical motors which are operated on short time periodic duty. So it involves frequent switching on and off. A few motors are assisted by VFDs (Variable Frequency Drives). Presently, only one such VFD assisted motor is in use with on-off the Presses.

The plant normally gets the electrical power from MSEDCL through a transformer of 250kVA capacity. But in the load shading conditions or as per the need the captive DG capacity of 125kVA is also available.

The Single Line Diagram presented in the next section explains the overall arrangement of the electrical power system.

4. SINGLE LINE DIAGRAM

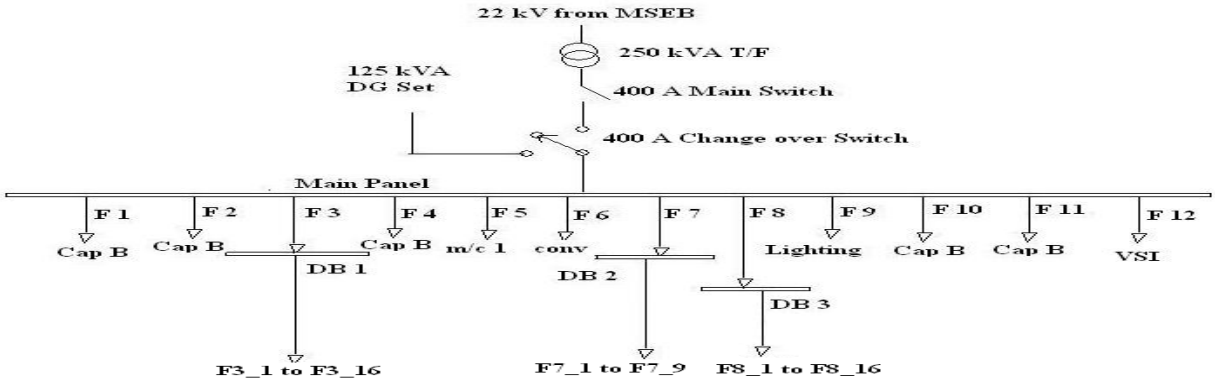

Figure1: Single line diagram

5. RESULT OF MEASUREMENT

A huge data base was stored automatically by the equipment YOKOGAVA CW240 Clamp on meter. The same data is plotted in the form of various plots as given below.

6. GRAPHS

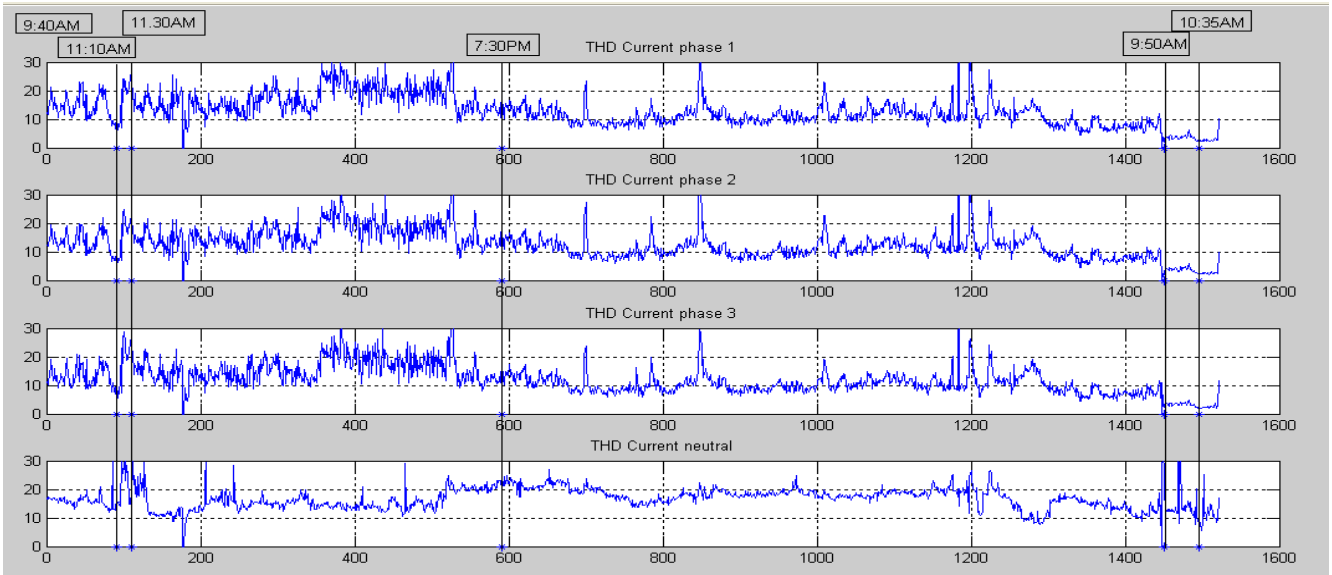

Figure 2: Current THD: Full Plant Load with and with VFD and on transformer or DG

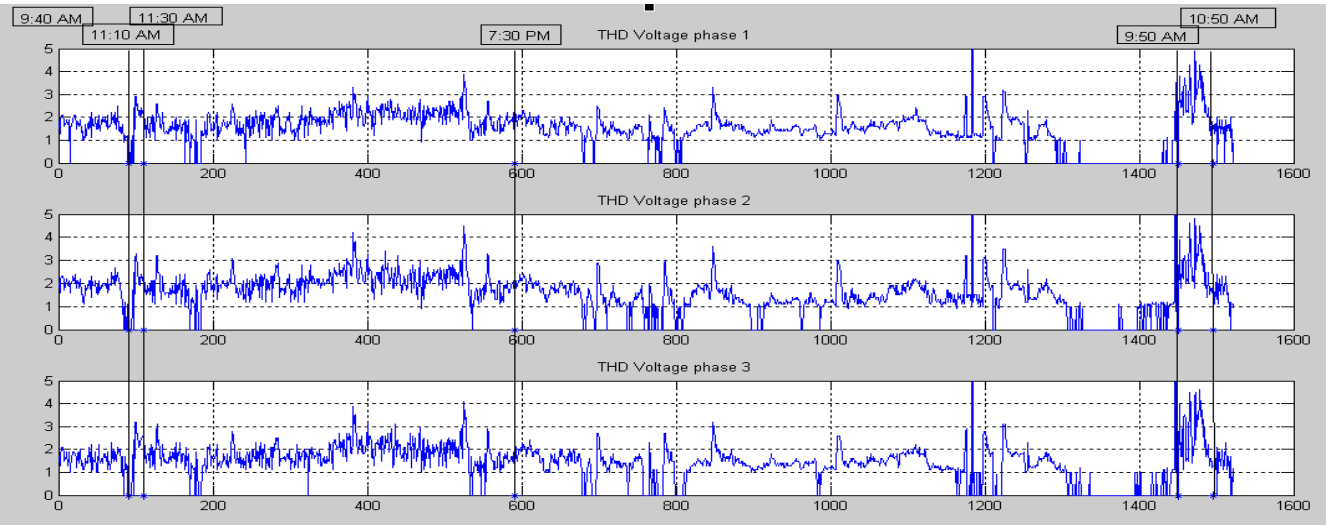

Figure 3: Voltage THD: Full Plant Load with and with VFD and on transformer or DG

7. TABULAR SUMMARY OF HARMONICS

Order of the Harmonics	3	5	7	9	11	13	15	17	19	21	THD
T/F with VFD	0-5	5-20	5-20	0-2	0-1.5	0-1	0	0	0	0	10-30

Table 1: Current Harmonics (percent)

Order of the Harmonics	3	5	7	9	11	13	15	17	19	21	THD
T/F with VFD	0	0-2	0-2	0	0	0	0	0	0	0	1-3

Table 2: Voltage Harmonics (percent)

8. CONCLUSION

The overall observation presented in the Tabular Summery and through the graphs of the different parameters reveals the following conclusive points:

1. The operation of the plant with transformer supply and VFD is more corruptive in nature producing 10 to 30% current THD, which is higher than specified levels.
2. Motive loads are producing 5^{th} and 7^{th} Harmonics in major proportion, than higher level harmonics.
3. Data collected by power analyzer consist of Line to line voltages, line currents, frequency, power factor, KVA, KW, KVAR, Voltage and Current harmonics which is used to analyze the power quality of industry.
4. This analyzed data is useful for MATLAB modeling, simulation and to design of harmonic filter.

REFERENCES

[1] 'Active power filters: A review' by M.El-Habrouk, M.K.Darwish and Pmehta
[2] Passive Harmonic Filters for Medium-Voltage Industrial Systems: Practical Considerations andTopology Analysis' by Alexandre B. Nassif, *Student Member, IEEE* and Wilsun Xu, *Fellow, IEEE*
[3] ARRILAGA, J., BRADLEY, D.A. and BODGER, P.S.: 'Power system harmonics
[4] D.A. Gonzalez. and J. C. McCaLL, 'Design of Filters to Reduce Harmonic Distortion in Industrial Power Systems' IEEE transactions on indlustry applications, vol. IA-23. no. 3. may/june 1987
[5] D.Sutanto,M.Boou-rabee,K.S.Tam,C.S.Chang'Passive and active Harmonic filters for industrial power system'
[6] Georg J.Wakileh'Power System Harmonics'
[7] IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems**.** IEEE Std 519-1992.
[8] IEEE Guide for Application and Specification of Harmonic Filters. IEEE Std 1531.-2003
[9] J. C. Das, Power System Analysis, Short-Circuit Load Flow and Harmonics, 2002.
[10] J. K. Phipps, J. P. Nelson, and P. K. Sen, "Power quality and harmonic distortion on distribution systems," IEEE Transaction on Industry Applications, vol. 3, no. 2, pp. 504– 512, March/April 1994.